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F. STONE

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HYDRAULIC TRIP SPEAR

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2 Sheets-Sheet 2

Fig. 4.

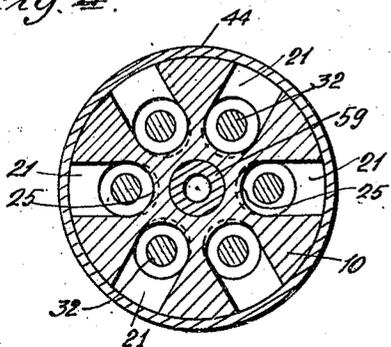


Fig. 5

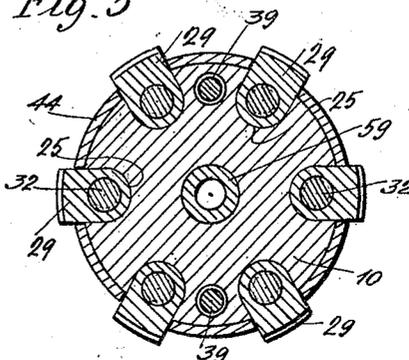


Fig. 7.

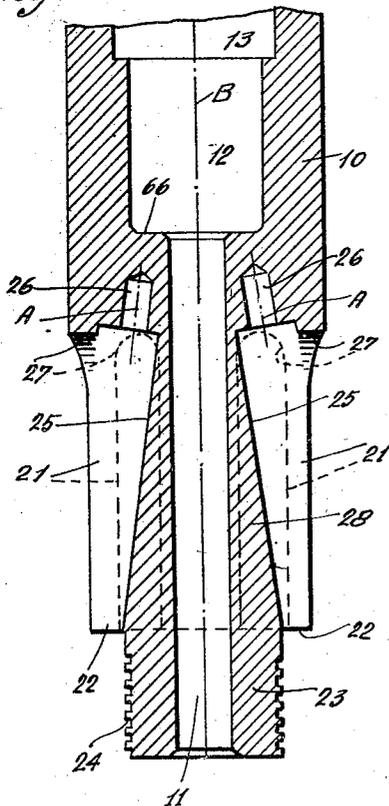
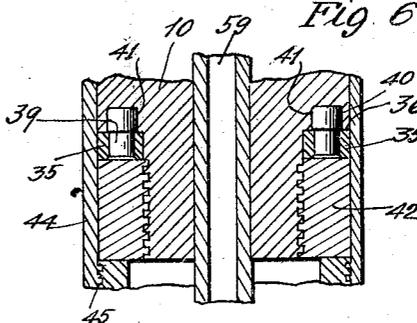


Fig. 6.



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HYDRAULIC TRIP SPEAR

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This invention has to do generally with tools for recovering "fishes" from oil wells and the like, and is more particularly concerned with the spear type of fishing tool.

5 A spear is in the nature of a tool adapted to be entered through the bore of tubular work, having jaws or gripping members which are maintained in a radially retracted or inoperative position as the tool is lowered
10 to working position and are then adapted to be radially expanded or projected into tight gripping engagement with the bore-defining wall of the work.

These spears are used to pull tight casing
15 strings or "lost" ends of casing strings which have parted in a well. It is essential that such tools have characteristics of great sturdiness and simplicity, both as regards construction and operation. They must be
20 strong enough to resist extremely severe pulling strains, which are often aggravated by the action of upwardly acting "jars", and yet must be of minimum bulk in order that they may be adaptable to various working
25 conditions.

It may be considered as a general object of my invention to provide a fishing tool which has all the necessary characteristics of adaptability, sturdiness, compactness and
30 general efficiency.

It being realized that the jaws or gripping members are necessarily movable, it will be seen that their mounting must be such that in spite of their capacity for such movement
35 they are capable of withstanding the severe service strains spoken of above. The jaws of my tool are of such a character and are so mounted that they are especially well adapted to resist such strains and yet their
40 bulk is not such as to render them unwieldy or to necessitate complicated, heavy actuating mechanisms.

The jaw actuating mechanism is of a nature enabling the driller to project or retract
45 the jaws irrespective of the depth at which the tool is working. It not only has all the strength necessary to meet the conditions mentioned above, but also is such that it may be operated surely, quickly and easily.

50 Another feature which is inherent in my

improved spear is the protection afforded against the jaws accidentally "hanging up" while the tool is being lowered into the hole or protruding and setting themselves while the tool is being pulled from the hole. The
55 arrangement whereby such hanging up or accidental setting is prevented may be discussed to better advantage in the detailed specifications to follow.

The arrangement of parts is such that there
60 may be provided a circulation passage through the entire tool so, as the tool is being lowered to its field of operation, circulating fluid may be passed therethrough and thus
65 utilized to flush the hole, clearing sand and debris from the path of the tool.

After a "fish" has been grappled by a spear it often happens that the first pulling operations fail to dislodge the fish. Rather than
70 overstrain the fishing string, with the chance of parting it under a continued pull, it is desirable that the spear be entirely detached from the fish and withdrawn from the hole. This withdrawal makes possible the circulation
75 of oil around the fish to loosen up the encircling sand, whereupon the grappling operation is repeated. I have therefore provided means whereby the spear may be disengaged from the fish when occasion demands
80 such an operation; the weight of the fishing stem being utilized to force the spear body downwardly in a manner to cause the jaws to recede from operative position. If this
85 operation fails to retract the jaws, the tool is rotated in a direction which causes the thread-like gripping faces of the jaws to cut threads upwardly through the work wall and
90 thus, in effect, unscrew the spear from the work. The gripping jaw threads are left-handed, that is, if the threads which connect the lengths of drill pipe are right handed, so
95 this thread cutting operation may be carried on without loosening the threaded joints of the fishing stem.

Other objects and novel features of the invention will be made apparent in the following
100 detailed description, reference being had to the accompanying drawings, in which:

Fig. 1 shows conventionally a bore hole and a tubular fish therein, a tool embodying my

invention being shown in association therewith. The tool is shown mostly in elevation, with parts adjacent its juncture with the fishing stem being shown in broken away section.

Fig. 2 is a longitudinal medial section through a tool embodying my invention, the upper end of the tool being broken off and the work-gripping jaws being in inoperative or radially retracted positions. The tool is shown as being inserted within work.

Fig. 3 is a view generally similar to Fig. 2 but shows the gripping jaws in radially projected or operative positions, a portion of the tool being shown in elevation.

Fig. 4 is a section on line 4—4 of Fig. 3.

Fig. 5 is a section on line 5—5 of Fig. 3.

Fig. 6 is a section on line 6—6 of Fig. 2; and

Fig. 7 is a detached medial section through the lower part of the spear body.

I have shown at 10 an elongated, tubular body having a relatively small bore 11 opening to the lower end thereof, a larger counter-bore 12 into which bore 11 opens, and a still larger counter bore 13 into which counter bore 12 opens. The upper end of the wall of bore 13 (Fig. 1) is threaded or otherwise suitably prepared to take a tubular joint or coupling member 14 whereby threaded connection is made to the tubular fishing stem generally indicated at 15. Stem 15 is made up of a plurality of pipe lengths 16 threadably coupled together by tubular tool joints 17 or the like. Stem 15 is supported from above in the usual manner through bail 18a of swivel 18, or the like, which carries a usual hose connection 19 for the transmission of fluid under pressure from a pump (not shown) to the stem bore, whence the fluid passes to the bore of the spear, as will hereinafter appear. I have shown conventionally at 20 a valve for controlling the fluid pressure, though it will be understood that this showing is made merely for purposes of illustration since the valve is ordinarily found directly at the pressure side of the pump.

Near the lower end of the body member 10 is a plurality of angularly spaced elongated recesses 21 which open sidewise to the outer peripheral face of the body member and open at their lower ends 22 around the reduced diameter portion 23 of the body, said portion being externally threaded as at 24. The inner or bottom walls 25 of the recesses incline downwardly and outwardly as clearly shown in Figure 7, and opening into the upper ends of said recesses are bores 26 whose axes A are substantially parallel to walls 25. Preferably, though not necessarily, walls 25 are arcuate as viewed in plan (Figs. 4 and 5) while the upper end walls 27 (Fig. 7) of the recesses are preferably arcuate as viewed in elevation. In the embodiment shown there are six recesses 21 in the body member, said recesses being spaced apart equally as viewed

in plan, and consequently a longitudinal medial section through two opposite recesses 21 give the effect shown in Fig. 7 wherein the portion 28 of the body which is defined by the opposite walls 25 may be considered as an upwardly pointing or upwardly converging wedge member through the center of which extends bore 11. Of course, it will be understood this showing and description of a certain number and particular placement of recesses is in no way to be considered as limitative on the invention but is referred to merely in order to bring out one aspect of a preferred embodiment thereof.

Mounted for sliding movement longitudinally through recesses or ways 21 are work-gripping jaws or wedge slips 29, these jaws being complementary in transverse cross section to the recesses (see Fig. 5) their inner longitudinal faces 30 being substantially parallel to and engaging walls 25, and their opposite, work-gripping faces 31 extending substantially parallel to the major axis B of the body member. Faces 31 are preferably serrated to provide parallel, upwardly pointing teeth 29a to give superior gripping qualities, and, for purposes to be described, preferably said teeth are cut in the form of threads, that is, they incline or extend at an angle of other than 90° with respect to the vertical axis of the individual jaw or with respect to axis B. The jaws are shorter in vertical extent than are recesses 21 to allow the jaws vertical or longitudinal play, and it will be seen that due to the angularity of walls 25 and faces 30 with respect to vertical axis B, relative vertical movement between the body and jaws, with said walls and faces in engagement, sets up relative horizontal or transverse movement between said body member and jaws, this transverse movement moving the jaws from the inoperative or retracted positions of Fig. 2 to the radially projected, operative positions of Fig. 3, or vice versa. Considering the assembly as viewed in plan and considering the work gripping means as a ring of gripping elements, it will be seen that vertical reciprocation of the jaws through the recesses may be considered as causing radial contraction or expansion of the work gripping ring.

While any suitable means may be employed for retaining the jaws in recesses 21 and guiding said jaws radially inward as they are being raised, I have provided a means which is particularly effective and advantageous from the manufacturing, assembling and operating standpoints. This means comprises a plurality of guide pins 32, one for each jaw, which pins extend through ways or bores 33 in the jaws, the upper ends 34 of the pins being lodged in body bores 26. A holding ring 35 is then slipped over body portion 23 and into engagement with the

downwardly facing shoulder 36 of said body portion to close off recess ends 22.

Ring 35 has vertical bores 37 which take the bent ends 38 of pins 32, and also carries dowels 39 (Figs. 2 and 6) whose upwardly projecting heads 40 fit into the complementary recesses 41 in the body member, which recesses open downwardly to shoulder 36. A retaining nut 42 is then threaded over body portion 23, serving to hold ring 35 in place against shoulder 36. Since dowels 39 hold the ring against rotation with respect to body 10, said ring serves to hold guide pins 32 against movement with relation to the body, maintaining them in a position in which they parallel the associated walls 25.

It will be seen that jaws 29 are held with their faces 30 in engagement with walls 25 throughout vertical movement of said jaws in either direction with respect to the body member and that by reason of the angularities specified said jaws are caused to move radially outward or to projected position when they are moved downwardly with relation to the body member and radially inward or to retracted position when they are moved upwardly with respect to the body member.

When the jaws are in fully retracted or inoperative position (Fig. 2) they project radially slightly beyond the peripheral face of body member 10 and into openings 43 in a propeller sleeve 44 which is mounted for vertical reciprocation about the outer face of member 10. Sleeve 44 is internally threaded at 45 to take the threaded portion 46 of pilot 47, which pilot serves the dual purpose of guiding the tool into the bore of work W and of providing a connector between the propeller sleeve and a piston generally indicated at 48, which piston is adapted to be reciprocated vertically through body bore 13 at a point above the jaws.

Pilot 47 is tubular in character, its cylindrical body portion 49 having an upwardly opening, relatively large bore 50 into which opens a smaller, internally threaded bore 50a in pilot nose 51. Bore 50a, in turn, communicates with nose port 52 which opens to the bottom of the tool. Nose 51 is formed by tapering or angling the lower end of the pilot as at 53 to bring the rounded end 54 offset with respect to axis B, so said angled face and offset nose can enter the bore of offset work W (Fig. 1) and center it in bore hole 55. Opening from pilot bore 50 to the outer face of the tool is a relief port 55 through which fluid leaking into the space between the pilot and body may be exhausted, the building up of fluid pressure in this space thus being prevented.

Piston 48 is made up of an upwardly opening cup leather 56 clamped between a ring 57, shouldered at 58 on tubular piston rod 59, and a nut or head 60 which is threaded at 61 on said rod. Head 60 is held detach-

ably against relative movement with respect to the piston rod by means of a set screw 62, and the upper end of said head has a flaring opening 63 which provides a guide for centering valve stopper 64 (Fig. 3) when the latter is dropped to place for purposes to be described.

Piston rod 59 extends downwardly through bores 13, 12, 11, and 50, having a sliding fit through bore 11, and is finally threaded at 64a into nose bore 50a. The piston rod thus connects piston 48 and pilot 49 so that vertical reciprocation of said piston with respect to body 10 causes like movement of the pilot and sleeve 44.

An expansive coil spring 65 encircles rod 59 within bores 13 and 12, one spring end engaging the under face of ring 57 and the other end engaging the upwardly facing shoulder 66 formed at the junction of bores 11 and 12. Spring 65 exerts a constant tendency to move piston 48 to the upper limit of its travel, this limit being established by contact of the upwardly facing annular shoulder 67 (Fig. 3) of pilot 49 with the downwardly facing shoulder 68 formed by the lower face of retaining nut 42, which nut, as noted above, is screwed fast to member 10.

Openings 43 in sleeve 44 are complementary in outline to jaws 29, as will be seen by reference to Figures 1, 2 and 3, and since, as has been stated, the jaws project into said openings when in their fully retracted position, it will be seen that when the sleeve is forced downwardly by depressing piston 48, the upper arcuate defining walls 69 of said slots act as depressing members against the upper ends of the jaws to move them downwardly and hence, due to the angularity of contacting faces specified above, radially outwardly through said sleeve openings. On the other hand, when the sleeve is moved upwardly about the body from the position of Figure 3 to that of Figure 2 by reason of upward movement of piston 48, the lower defining walls 70 of the recesses act against the lower ends of the jaws to raise them, which upward vertical movement is accompanied by radial retractive movement of the jaws due to the formation and arrangement of parts specified above.

Sleeve 44 is of such length and so positioned that it entirely covers the recesses 21, except for the parts occupied by the jaws, throughout vertical reciprocation of the sleeve, and since the jaws have sliding fit throughout with the recesses, it will be seen that said sleeve forms a housing to prevent the entrance of debris to the recesses above or below the jaws.

The relative dimensional characteristics and the radial stroke of the jaws are preferably such that when said jaws are fully retracted their teeth 29a are either just flush with or slightly below the peripheral face of

sleeve 44 and when the jaws are fully projected said teeth are radially well beyond said peripheral face. Since spring 65 is of a strength to hold the jaws normally retracted so that teeth 29a do not project beyond the sleeve, the tool may be lowered through the hole H, casing (not shown) which may be disposed in said hole, or tubular work W, without danger of the jaws engaging any of the bore defining walls, with obvious advantage, the sleeve thus serving both as a propeller and clearance maintainer for the jaws.

Description of the operation of the tool follows. With the parts in the position of Figures 1 and 2, the tool is lowered through hole H, being guided into the bore of work W by pilot nose 51. During this lowering movement circulating fluid may be pumped through stem 16, bore 13, the hollow piston rod and bores 50, 52 to flush away debris from the path of the tool. The pressure of this circulating fluid is controlled so that it will not overcome the effect of spring 65 to set the jaws.

When the tool has been lowered the requisite distance into work W, its descension is checked and piston 48 is moved downwardly under the imposition of increased hydraulic pressure. The pressure may be built up on head 60 so that the latter is depressed in spite of the fact that a limited amount of fluid is free to pass through the piston rod bore and out the bottom of the tool. Preferably, however, the bore through the tool is stopped off so the entire fluid pressure is effectively directed against piston 48. This is done by dropping a ball stopper 64 through the bore of stem 15, the ball dropping or being forced by fluid pressure downwardly to a point where it is guided by conical wall 63 onto seat at that end of piston rod 59 which is presented at the bottom of said conical wall (see Fig. 3). Stopper 64 thus closes off the bore of the hollow piston rod and all the fluid pressure is directed in a manner to cause depression of piston 48. Depression of the piston compresses spring 65, and, through rod 59 and pilot 49 moves sleeve 44 downwardly in a manner to force the jaws down and hence radially outward into the position of Figure 3, where the work gripping faces 31 are shown in gripping relation with work W, that is, teeth 29a are sunk in said work.

With the jaws thus moved to gripping position, stem 15 is lifted by usual hoisting tackle (not shown), tending to carry with it the work W. It will be noted that the upward strain of stem 15 is imparted to jaws 29 through contact with the upper face of ring 35 with the lower faces of the jaws, and the mounting of said ring on the body and the manner in which it is backed up by nut 42 render the tool well adapted to transmit these terrific pulling strains to the fish without

danger of the tool-parts or assembly thereof giving way.

If the piston does not push the cutters to fully projected position, it will be seen that the upward pull exerted on body 10 tends to set up such relative vertical movement between the jaws and body that the jaws are wedged by portion 28 more tightly into engagement with the work.

If the fish fails to come free, or if for any other reason it is desired to release the tool from the fish, the piston is relieved from hydraulic pressure and stem 15 is allowed to drop under gravity by proper control of the hoisting tackle. The weight of stem 15 then tends to force the body 10 downwardly; the jaws, due to their engagement with the work, and the sleeve 44 tending to remain stationary. The relative movement between the body member and sleeve thus set up causes, through the action of inclined pins 32 with the inclined jaw ways 33, said jaws to move radially inward toward the contracted position of Figure 2, spring 65 completing the retractive movement as soon as the jaws have been freed from the work and thereafter serving to hold the jaws in retracted position so they will not accidentally reengage the work or any tubular member through which it may be drawn in being pulled to the top of the hole.

Occasionally the jaws gain such a hold on the work that they cannot be readily freed therefrom by the operation just described. Other means are then employed for freeing the tool from the fish. As noted above, the work gripping faces 31 of the jaws are in the form of teeth 29a having thread characteristics. Assuming that all the threaded joints 14 and 17 in stem 15, are right-handed ones, teeth 29a are made in the form of left hand threads. Accordingly, if stem 15 be rotated right-handedly, there consequently being no tendency to loosen its threaded joints, the left hand threads 29a will cut corresponding threads in the work and, with proper control of the hoisting tackle and rotary table, the jaws will thus thread themselves and the entire tool out of the work bore. As soon as they have cut their way out, spring 65 becomes effective to lift the piston, piston rod, nose, sleeve and jaws to the positions of Figure 2, the jaws thus being moved to retracted positions.

In connection with this rotation of body 10 for threading the tool out of the work, it will be noted that jaws have such fit in recesses 21 that they are held from movement circumferentially of the work and are well backed up by the body during the time there is a tendency to give them circumferential movement. This fact is well shown in Figure 5. It may be also noted by reference to Figures 2 and 3 that the jaws are fully backed up from end to end by bottom walls 25, irrespec-

tive of the position to which said jaws have been projected, the cross section of body between jaws and the radial cross sectional extent of said jaws being such that the terrific reaction strains of radial compression during operation of the tool are effectively cared for.

It will be understood the drawings and description are to be considered merely as illustrative of and not restrictive on the broader claims appended hereto, for various changes in design, structure and arrangement may be made without departing from the spirit and scope of said claims.

I claim:

1. In a trip spear, an elongated body member adapted to be lowered into the bore of vertically extending, tubular work, a sleeve mounted about the body member for vertical reciprocation thereover, said sleeve having an opening through its wall, a work gripping jaw directly carried by the body member and movable radially with respect thereto and through said opening into and out of work gripping position, and means for reciprocating said sleeve, said jaw being movable to and from work gripping position by virtue of said sleeve movement.

2. In a trip spear, an elongated body member adapted to be lowered into the bore of vertically extending, tubular work, a sleeve mounted about the body member for vertical reciprocation thereover, said sleeve having an opening through its wall, a work gripping jaw directly carried by the body member and movable radially with respect thereto and through said opening from an inoperative position to a work gripping position, and means for reciprocating said sleeve, said jaw being movable from one position to the other by virtue of sleeve movement in one direction.

3. In a trip spear, an elongated body member adapted to be lowered into the bore of vertically extending, tubular work, a sleeve mounted about the body member for vertical reciprocation thereover, said sleeve having an opening through its wall, a work gripping jaw directly carried by the body member and movable longitudinally with respect to the body, coacting means on the jaw and body whereby longitudinal movement of the jaw with respect to the body moves said jaw radially with respect to the body through said opening into and out of work gripping position, and means for reciprocating said sleeve, said jaw being movable longitudinally with respect to the body by virtue of said sleeve movement.

4. In a trip spear, an elongated body member adapted to be lowered into the bore of vertically extending, tubular work, a sleeve mounted about the body member for vertical reciprocation thereover, said sleeve having an opening through its wall, a work gripping jaw directly carried by said body member and movable radially with respect thereto

and through said opening from an inoperative position to a work gripping position, and hydraulic pressure means for moving the sleeve in one direction longitudinally, said jaw being movable from one position to the other by virtue of such sleeve movement.

5. In a trip spear, an elongated body member adapted to be lowered into the bore of vertically extending, tubular work, a sleeve mounted about the body member for vertical reciprocation thereover, said sleeve having an opening through its wall, a work gripping jaw directly carried by said body member and movable radially with respect thereto and through said opening from an inoperative position to a work gripping position, and spring means for moving the sleeve in one direction longitudinally, said jaw being movable from one position to the other by virtue of such sleeve movement.

6. In a trip spear, an elongated body member adapted to be lowered into the bore of vertically extending, tubular work, a sleeve mounted about the body member for vertical reciprocation thereover, said sleeve having an opening through its wall, a work gripping jaw directly carried by said body member and movable radially with respect thereto and through said opening from an inoperative position to a work gripping position, hydraulic pressure means for moving the sleeve in one direction longitudinally, said jaw being movable from one position to the other by virtue of such sleeve movement, and spring means for moving the sleeve longitudinally in the opposite direction, said jaw being movable from said other to said one position by virtue of such opposite sleeve movement.

7. In a trip spear, a vertically extending body member, said body member having a recess therein which opens to the outer face thereof, a jaw adapted to play vertically through said recess and movable by virtue of said play into and out of operative position, and a sleeve about said body and reciprocable vertically thereover, said sleeve having an opening therethrough to take and expose the jaw to the outside of the spear, said sleeve being adapted to cover said recess around the jaw throughout sleeve reciprocation.

8. In a trip spear, a vertically extending body member, said body member having a recess therein which opens to the outer face thereof, a jaw adapted to play vertically through said recess and movable by virtue of said play into and out of operative position, and a sleeve about said body and reciprocable vertically thereover, said sleeve having an opening therethrough to take and expose the jaw to the outside of the spear, said sleeve being adapted to cover said recess around the jaw throughout sleeve reciprocation, and said sleeve engaging said jaw to move it ver-

tically through the recess in one direction when said sleeve is moved vertically in one direction.

9. In a trip spear, a vertically extending body member, said body member having a recess therein which opens to the outer face thereof, a jaw adapted to play vertically through said recess and movable by virtue of said play into and out of operative position, and a sleeve about said body and reciprocable vertically thereover, said sleeve having an opening therethrough to take and expose the jaw to the outside of the spear, said sleeve being adapted to cover said recess around the jaw throughout sleeve reciprocation, and said sleeve engaging said jaw to move it vertically through the recess in opposite directions when said sleeve is moved vertically in opposite directions.

10. In a trip spear, a vertically extending body member, there being a vertically extending recess in said body member, which recess opens to the outer face of said body member, the bottom wall of said recess inclining outwardly and downwardly, a jaw having an inner and outer face and being mounted in said recess for movement vertically therethrough with its inner face in engagement with said bottom wall of the recess, the outer, work gripping face of the jaw extending parallel to the body axis, and means movable over the outside of the body member for moving said jaw vertically in both directions.

11. In a trip spear, a vertically extending body member, there being a vertically extending recess in said body member, which recess opens to the outer face of said body member, the bottom wall of said recess inclining outwardly and downwardly, a jaw having an inner and an outer face and being mounted in said recess for movement vertically therethrough with its inner face in engagement with said bottom wall of the recess, the outer, work gripping face of the jaw extending parallel to the body axis, means for maintaining said inner jaw face in contact with said recess wall during vertical reciprocation of the jaw and means movable over the outside of the body member for moving said jaw vertically in both directions.

12. In a trip spear, a vertically extending body member, there being a vertically extending recess in said body member, which recess opens to the outer face of said body member, the bottom wall of said recess inclining outwardly and downwardly, a jaw having an inner and an outer face and being mounted in said recess for movement vertically therethrough with its inner face in engagement with said bottom wall of the recess, there being a way through said jaw parallel to said recess bottom wall, a guide pin supported in said recess by the body and extending parallel to said bottom wall and

through said jaw way, and means without said recess for moving said jaw vertically.

13. In a trip spear, a vertically arranged tubular body member, a work gripping jaw mounted on the body for vertical movement with relation thereto, coacting means on the body and jaw whereby relative vertical movement of said jaw and body moves the jaw radially with respect to the body, a piston mounted for vertical reciprocation in the body bore, a vertically movable propeller sleeve encircling and carried by the body and applied to the jaw for moving it vertically, and a rigid operative connection between the piston and propeller whereby vertical movement of the piston in one direction moves the jaw vertically in one direction.

14. In a trip spear, a vertically arranged tubular body member, a work gripping jaw mounted on the body for vertical movement with relation thereto, coacting means on the body and jaw whereby relative vertical movement of said jaw and body moves the jaw radially with respect to the body, a piston mounted for vertical reciprocation in the body bore, a vertically movable propeller mounted on the outside of the body and applied to the jaw for moving it vertically, and an operative connection between the piston and propeller whereby vertical movement of the piston in one direction moves the jaw vertically in one direction.

15. In a trip spear, a vertically arranged tubular body member, a work gripping jaw mounted on the body for vertical movement with relation thereto, coacting means on the body and jaw whereby relative vertical movement of said jaw and body moves the jaw radially with respect to the body, a piston mounted for vertical reciprocation in the body bore, a vertically movable propeller sleeve carried about the body and applied to the jaw for moving it vertically, an operative connection between the piston and propeller whereby vertical movement of the piston in one direction moves the jaw vertically in one direction, and a spring acting between the body and piston to move the piston and jaw in the opposite direction.

16. In a trip spear, a vertically arranged tubular body member, a work gripping jaw mounted on the body for vertical movement with relation thereto, coacting means on the body and jaw whereby relative vertical movement of said jaw and body moves the jaw radially with respect to the body, a piston mounted for vertical reciprocation in the body bore, a vertically movable sleeve about the body and engaging the jaw in a manner whereby vertical movement of the sleeve in one direction moves the jaw vertically in one direction, a piston rod extending downwardly through the body bore to a point below the jaw, and a member connecting the lower end of the piston rod to the sleeve, whereby ver-

tical movement of the piston in one direction moves said sleeve in said one direction.

17. In a trip spear, a vertically arranged tubular body member, a work gripping jaw mounted on the body for vertical movement with relation thereto, coacting means on the body and jaw whereby relative vertical movement of said jaw and body moves the jaw radially with respect to the body, a piston mounted for vertical reciprocation in the body bore, a vertically movable sleeve about the body and engaging the jaw in a manner whereby vertical reciprocation of the sleeve in one direction reciprocates the jaw vertically, a piston rod extending downwardly through the body bore to a point below the jaw, and a member connecting the lower end of the piston rod to the sleeve, whereby vertical reciprocation of the piston reciprocates said sleeve in said one direction.

18. In a trip spear, an elongated body member adapted to be lowered into the bore of vertically extending, tubular work, a plurality of work gripping jaws mounted in the body member and movable from an inoperative position longitudinally and radially outwardly with respect to the body member into a work gripping position, hydraulic pressure means for so moving the jaws, the work gripping faces on said jaws being in the form of threads, and means limiting movement of the jaws circumferentially of the body throughout such longitudinal movement.

19. In combination with a fishing string made up of pipe lengths coupled by right hand threads, and a trip spear coupled to the string, said spear embodying an elongated body member adapted to be lowered into the bore of vertically extending, tubular work, a work gripping jaw mounted in the body member and movable from an inoperative position longitudinally and radially outwardly with respect to the body member into a work gripping position, hydraulic pressure means for so moving the jaw, the work gripping faces on said jaws being in the form of left hand threads, and means limiting movement of the jaw circumferentially of the body throughout such longitudinal movement.

20. In a trip spear, a vertically extending body member, said body member having a recess therein which opens to the outer face thereof, a jaw adapted to play vertically through said recess and movable by virtue of said play into and out of operative position, and a sleeve about said body and reciprocable vertically thereover, said sleeve having an opening therethrough to take and expose the jaw to the outside of the spear.

21. In a trip spear, a vertically extending body member, said body member having a recess therein which opens to the outer face thereof, a jaw adapted to play vertically through said recess and movable by virtue of said play into and out of operative posi-

tion, and a sleeve about said body and reciprocable vertically thereover, said sleeve having an opening therethrough to take and expose the jaw to the outside of the spear, and said sleeve engaging said jaw to move it vertically through the recess in one direction when said sleeve is moved vertically in one direction.

22. In a trip spear, a vertically extending body member, said body member having a recess therein which opens to the outer face thereof, a jaw adapted to play vertically through said recess and movable by virtue of said play into and out of operative position, and a sleeve about said body and reciprocable vertically thereover, said sleeve having an opening therethrough to take and expose the jaw to the outside of the spear, and said sleeve engaging said jaw to move it vertically through the recess in opposite directions when said sleeve is moved vertically in opposite directions.

23. In a trip spear, a vertically arranged tubular body member, a work-gripping jaw mounted on the body for vertical movement with relation thereto, coacting means on the body and jaw whereby relative vertical movement of said jaw and body moves the jaw radially with respect to the body, a tubular piston mounted for vertical reciprocation in the body bore, a vertically movable propeller sleeve encircling and carried by the body and applied to the jaw for moving it vertically, and an operative connection between the piston and propeller whereby vertical movement of the piston in one direction moves the jaw vertically in one direction, the piston bore communicating with the body bore and opening, in effect to the outside of the spear.

24. In a trip spear, a vertically arranged tubular body member, a work-gripping jaw mounted on the body for vertical movement with relation thereto, coacting means on the body and jaw whereby relative vertical movement of said jaw and body moves the jaw radially with respect to the body, a tubular piston mounted for vertical reciprocation in the body bore, a vertically movable propeller carried by the body and applied to the jaw for moving it vertically, and an operative connection between the piston and propeller whereby vertical movement of the piston in one direction moves the jaw vertically in one direction, the piston bore communicating with the body bore at a point above said jaw and opening, in effect, to the outside of the spear at a point below said jaw.

25. In a trip spear, a vertically arranged tubular body member, a work-gripping jaw mounted on the body for bodily movement radially with respect thereto, a tubular piston mounted for vertical reciprocation with respect to the body member, said jaw being movable radially in one direction under the

influence of piston movement in one direction; the piston bore communicating with the body bore at a point above said jaw and opening, in effect, to the outside of the spear at a point below said jaw, and a stopper seat on said piston about its bore to receive a stopper dropped through said body bore.

26. In a trip spear, a vertically arranged tubular body member, a work gripping jaw mounted on the body for vertical movement with relation thereto, coacting means on the body and jaw whereby relative vertical movement of said jaw and body moves the jaw radially with respect to the body, a piston mounted for vertical reciprocation in the body bore, a vertically movable propeller carried by the body and applied to the jaw for moving it vertically, and an operative connection between the piston and propeller whereby vertical movement of the piston in one direction moves the jaw vertically in one direction, there being a fluid passageway through said spear from the body member bore to the outside of the spear at a point below said jaw.

27. In a trip spear, a vertically arranged tubular body member, a work-gripping jaw mounted on the body for radial and vertical movement with respect thereto, a pilot mounted for movement vertically with respect to the body member, hydraulic pressure means for moving the pilot, and an operative connection between the pilot and jaw whereby pilot movement in opposite directions moves the jaw vertically with respect to the body in opposite directions.

28. In a trip spear, a vertically arranged body member, a work-gripping jaw mounted on the body for vertical movement with respect thereto, coacting means on the body and jaw whereby relative reciprocatory vertical movement of said jaw and body moves the jaw radially with respect to said body to and from work-gripping position, a propeller sleeve about the body and applied to the jaw and movable in one direction to move the jaw to work-gripping position, and a shoulder on said body member adapted to engage said jaw to limit the last named movement.

29. In a trip spear, a vertically arranged body member, a work-gripping jaw mounted on the body for vertical movement with respect thereto, coacting means on the body and jaw whereby relative vertical movement of said jaw and body moves the jaw radially with respect to said body, a propeller sleeve about the body and applied to the jaw and movable in opposite directions to move the jaw vertically in opposite directions, and a pair of vertically spaced, stationary shoulders on said body member adapted to engage said jaw to limit movement thereof in said opposite directions.

30. In a trip spear, a vertically extending

body member, there being a plurality of circumferentially spaced, vertically extending recesses in said body member, which recesses open to the outer face and toward the lower face of the body, a plurality of jaws mounted, one each, in said recesses for movement therethrough, said jaws being enterable in said recesses through the downward openings of the recesses, and a single stationary keeper detachably connected to said body to close off all of said downward openings after the jaws have been entered.

31. In a trip spear, a vertically extending body member, a plurality of guide pins circumferentially spaced about the body member and inclining downwardly and outwardly with respect to the vertical axis thereof, said pins being individually positioned at one end by the body member, and a single detachable holding element applied to the body member near the other ends of the pins and engaging said other ends of all the pins to hold them positioned.

32. In a trip spear, a vertically extending body member, a plurality of guide pins circumferentially spaced about the body member and, throughout the major portion of their extent, inclining downwardly and outwardly with respect to the vertical axis thereof, said pins being individually positioned at their upper ends by the body member, the lower ends of said pins extending substantially parallel to said vertical axis, and a detachable annular member applied near the lower ends of the pins to said body member and releasably held against movement with respect to said body member, said annular member having vertically extending openings taking individually all the lower ends of said pins, said annular member thereby positioning said lower ends.

In witness that I claim the foregoing I have hereunto subscribed my name this 1st day of May, 1929.

FREDERICK STONE. 110

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